The Invention of the Roller Flour Mill

By Publius Virgilius Lawson, LL. B.

[From Proceedings of the State Historical Society of Wisconsin, 1907]

MADISON
STATE HISTORICAL SOCIETY OF WISCONSIN
1908

John Stevens, of Neenah

Inventor of the roller flour mill. From photograph by Stimpson

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Wheat forms the principal source of the food of the race. Its milling into flour was among the earliest industrial activities of mankind. It was a citizen of Wisconsin who made the greatest improvement in the milling or grinding of wheat, and in the flour product as well as in the reduction of cost, that had been brought about in all the history of the world. It is an honor to our State that the invention which is outlined in this paper takes rank with the greatest inventions and discoveries of history.

Up to about thirty years ago, methods of milling were approximately but refinements of the earliest methods, a short review of which will aid us in understanding this invention. J. P. Schumacher of Green Bay has in his collection a log, two feet long, with a deep cavity worked into one end in which reposes a long pestle with a rounded head. In primitive days this was used by Menominee Indians to pulverize their maize; and after contact with the whites, their wheat. On the bank of Fox River, on Doty Island, near the old log house of Governor Doty, there is a green stone boulder with a slightly-polished cavity, which was used by Winnebago for the same purpose. Similar artifacts have been recovered from the ancient lake dwellings in Switzerland, such as a rounded stone, the size of the hand, fitting a cavity in another stone between whose surfaces wheat was pulverized. By fitting the upper stone for rotation, the original primitive mill

called the quern would be formed. The preparation of meal or flour was part of the domestic duties in times as remote as Abraham. Sarah was asked to "make ready quickly, three measures of fine meal." This also shows an early distinction in the product. Similar primitive milling devices are described by Livingstone in Africa, and exist in India to this day. In Deuteronomy it is laid down, "that no man shall take the nether or the upper mill stone to pledge, for he taketh the man's life to pledge." Among the Hebrews and Romans the women made both the flour and the bread. It was not until a hundred and seventy-three years before Christ that the first baker introduced the craft, and the first male baker was his own miller. Larger stones were used and horse power employed; then water power made one stone rotate on the other. A pair of Roman mill stones were found in Adel, in Yorkshire. In very early times in England, the maid was the miller as well as baker; King Ethelbert imposed a penalty upon "any man who should corrupt the king's grinding maid."

Sir Walter Scott has described the primitive water mills in Scotland. Dr. Johnson mentions in his travels the crude water mills there, declaring that when these were too far distant, the housewife would grind her oats with the quern, or hand mill, which he describes. This was a small mill, consisting of a stone with a cavity, into which fitted another stone with a handle, also having a hole in the centre, through which the kernels of corn passed between the stones, when the upper was rotated. The lower stone had a spout below, through which the meal fell into a basin.

Improvements in the art, and an increased demand, brought into use in quite early times the mill or buhr-stones, as known for hundreds of years in milling practice (see Figure 1). The best stone of which to make these was found in France. Rubble blocks formed into a round wheel 50 inches in diameter, and a foot thick, bound together with iron tires, dressed flat on one side, and then dressed or grooved, so that when one is rotated on the other, the picked or grooved lines will act

on the grain run through them, like a pair of scissors, "and thus the effect of the stone on the grain is at once cutting, squeezing, and crushing." As the kernel of wheat is composed of five parts, with several hard and cellular coats as well as the germ, much of which is not wanted in the flour, this method of crushing and pulverizing all into a mixed mass of fine particles, made it next to impossible to refine or separate a good grade of flour from the mixture of bran middlings, dust, and germ. In Hungary, the great milling centre of the European continent, they made black bread. There was a tax laid on each run of stone; and the demand for flour increasing, rather than add more run of stone, they devised a cutting machine to aid the stone. This was composed of a set of wooden or iron rolls having their faces fitted with numerous sharp teeth or knives, through which the grain was passed, cutting it into shreds, which were then run through between the mill stones, and ground to powder (see Figure 2). This process greatly increased the product of the stones, and saved the payment of the tax. This wheat saw-mill used to aid the stone was the only roller mill devised in Hungary; but was not the non-cutting roller mill invented in Neenah, now the milling method generally used throughout the civilized world.

A finer taste in England constantly demanded from the skill of the miller a whiter flour. His effort was, therefore, put forth to the utmost to refine the pulverized mass that poured from between the mill stones; but his best product only resulted in about twenty per cent or one fifth good flour—flour that was granular and light-colored or white; the bran and middlings discarded were still rich in food values, and the milling methods were still crude. In the United States, Rochester early became a great milling centre, and about 1868–70 Neenah, Wisconsin, was a leading Western milling mart.[1] In 1860 Minneapolis was a saw-mill town with a

[1] In 1879 there were seven flour mills in the city of Neenah, making fourteen hundred and twenty-five barrels of flour daily, with an annual output worth $2,565,000.—Richard J. Harney, *History of Winnebago County* (Oshkosh, 1880).

population of 5,809. By 1870 its population had increased to 13,066. Fifteen years later, after the introduction of the roller mill for the hard spring wheat, there were 129,200 people in this city, and it had sent a million people into Minnesota and Dakota to raise hard wheat.

The difficulty of the miller's problem is best understood by a study of the wheat kernel itself. After it had passed between the primitive mill stones, the question was how to separate the mass into its constituent parts. The hopelessness of success lay in the fact that the stones had so crushed the parts together, that it was impossible for the bolting cloth to separate the different particles. The centre of the wheat kernel is a fine starch. In the crease at one end is located the germ, which is soft and oily. This makes the low-grade flour. The outer coat is a hard, horny covering, which produces bran. The inner coat is a finer covering making middlings. Between these two there is a cellular coat designed to keep the germ from freezing. In winter wheat these cells are dark; but in the spring or Minnesota red or hard wheat they are almost black, and by the old process were pulverized as fine as flour. Next beneath the middling coat is deposited the granular flour that is most highly prized as whitest and most nutritious, and sells for the highest price. There is more of this granular flour in the hard spring wheat than in the softer winter wheat. Winter wheat was largely raised in Wisconsin, Iowa, Kansas, and Missouri, and St. Louis became a centre for its milling. Even if particles of the coats and cells became mixed with this flour it still was whiter than that produced by the hard Dakota wheat, which though richer in flour matter made unprofitable flour, and sold for five to thirty cents less per bushel than Wisconsin winter wheat. The hard northern wheat, which is today the nucleus of the flour-milling industry, was rejected for want of mechanical devices to utilize it. Such in brief was the state of this industry, when the invention of the Stevens non-cutting roller mill changed the whole milling process.

John Stevens, the inventor of the roller flour mill, was born

December 4, 1840, in Llechryd, Cardiganshire, four miles out of Cardigan, Wales, son of John and Elizabeth Bowen Stevens, natives of Wales. By trade the father was a landscape gardener and was engaged on neighboring landed estates. With his family he early emigrated to Canada. They in 1850 removed to Fremont, Ohio; and in 1854, to Neenah, Wisconsin, making the journey by the Michigan Southern Railway to Chicago, thence by boat to Green Bay, where they took the Fox River steamer "Pioneer" to Kaukauna, and then went by team to Neenah. With the father came his wife, his sons Ebb and John and daughter Eliza. The latter married Rev. R. W. Davis, a Welsh pastor, and both soon returned to Wales where she died. Ebb Stevens became a soldier and farmer. The father died in Neenah in 1885 at 96 years of age.

John Stevens, the inventor, was thirteen years of age when he landed in Neenah, where he has since made his home. It devolved upon him at this early age to become the main support of the family and he went to work in the flour mills. He was obliged to be self-supporting and to maintain his parents, to be self-educated, and he became in the broadest sense a self-made man. He commenced in the mills as a helper and sweeper; and in 1859, was elevated to the position of flour packer at the mill of Smith and Proctor; and the next year went as miller with John Mills, in the brick mill on the upper race. Here occurred the events which changed the milling practice of the world. There came from the East at this time, one named Tom Oborn, whom Mr. Stevens regards as the best miller he ever knew; he was engaged to peck or dress stone in the brick mill, then operated by John Mills. Oborn was born in England, and learned the trade of miller in that country. After a milling career in Neenah of about ten years, he became head miller at Brandon, Fond du Lac County, where he died in 1874.

It was from Tom Oborn that Mr. Stevens learned how to dress stone, and this was different from all milling practice then in use, and different from that taught in the books. It

was the practice among all millers to pick the face of the stone in sharp-edged grooves, so that they would cut, slash, and rip as well as crush and pulverize the mass between the stones. By this method the best bolting system devised could only separate twenty per cent of good flour. The method used by Tom Oborn was not to pick the stone, but to leave it as smooth as possible. He merely picked off the higher parts left by the wearing of the stone; and then when the mill was started ran water through them to aid in smoothing them down. By the stone-dressing practice of Tom Oborn the mill was enabled to produce twenty-five per cent of good flour, or five barrels more out of every one hundred barrels made, than any other mill. This flour was worth $2.00 per barrel, more than the lower or darker grade. Oborn taught Stevens the secret of his methods and thus assisted him to make a success as a miller.

A stone mill, erected at Neenah by Smith and Lisk, was operated under lease by A. W. Patton, and Stevens was engaged as boss miller. Soon afterward he commenced business for himself with Sam Oborn as Oborn and Stevens, in a flour mill leased of J. and H. Kimberly; and in 1861, the firm bought the Stone mill, Mr. Stevens selling his interest to Sam Oborn in 1864. In this year Stevens commenced his career with J. L. Clement, by forming a partnership and purchasing the brick mill built by John Mills, which adjoined the old stone mill of Smith and Lisk. The latter was then owned by Olmstead, from whom in 1873 it was purchased by Clement and Stevens and the stone and brick mills were united. After successfully operating these mills for seventeen years Stevens sold out to his partner and gave up the milling business. During the term of this partnership he had made the invention of the roller mill, demonstrated its superiority, and obtained his patents. When Stevens in 1881 sold his interest in the flour milling business, he was a wealthy man, having at forty years of age acquired a fortune.

Beginning as a Welsh emigrant, he had to learn the science and art of milling, and had become a success both as a miller

and as a business man. When asked where he obtained his mechanical ability he replied, that his ancestors were all mechanics and inventors, that his skill came by inheritance, and new devices suggested themselves readily to his mind. He invented a self-priming pump, and an automatic paint brush for marking barrel heads. His patented automatic and register scale he regards as among the most useful millers' devices. This was sold to the trust, with his roller mill patents, in 1893.

Pondering over the reason why the smooth milling stone as taught him by Tom Oborn would make better flour and more good flour than the old method, it occurred to him that the explanation lay in less cutting and powdering of the husk of the berry. The wheat kernel was rolled open and the flour separated without so much pulverizing of the outer coat, and the separation by the bolts resulted in a larger percentage of good flour. His mind was constantly employed in thinking out some mechanical device that would open the berry and leave the bran practically intact. Any radical change in the milling system that had existed during all the history of the world seemed impossible. However, the idea of crushing the wheat between rolls occurred to him. He kept it constantly in his mind. Every new device that suggested itself came back to the rolls. He made numerous drawings, then a crude model, then wooden rollers; finally between 1870 and 1872 he had some chilled rolls made. They were twelve inches in diameter and two feet long. These he sent to Cincinnati to have a corrugation cut on their faces; but they could not cut the hard steel. He tried the Pusey and Jones machine shops at Wilmington, Delaware, but they could not cut his rolls. Finally he sought the famous roll-makers at Ansonia, Connecticut, Farrell and Sons. They could not cut the chilled rolls; but they made him a pair of rolls in which they could cut the corrugation upon the face. He had now obtained his rolls and had his frame made to operate them. Then he invented a device to feed the wheat evenly along the slight opening between the rolls, and began

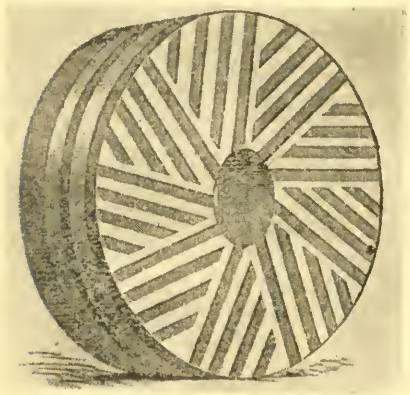

FIGURE 1

The upper buhr stone, used for centuries in grinding flour, showing the manner of pecking or dressing the contact surface. From the *Encyclopædia Britannica*

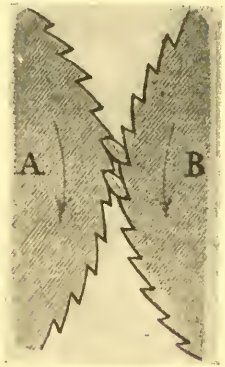

FIGURE 2

Section of the Hungarian roller mill, used to aid the buhr stone to increase the product; showing a cross section of the rolls, with the saw knife or toothed surface. From the *Encyclopædia Britannica*.

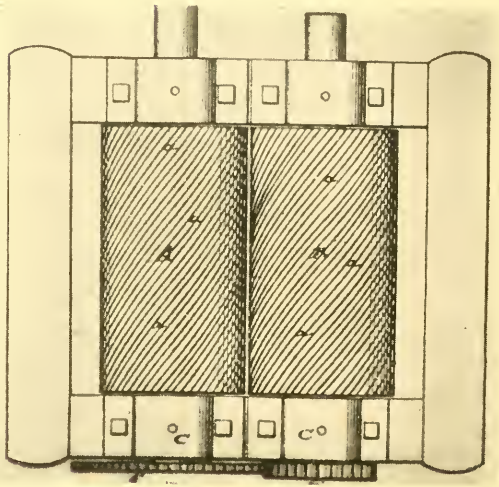

FIGURE 3

The non-cutting rib-corrugated Stevens rolls for grinding flour, which replaced all other milling systems. The frames, hopper, and wheat feed for mounting the Stevens rolls, are usually the design of the manufacturer, taking the name of the designer of the frame; but all mill-furnishers use the Stevens rolls. From Patent No. 225,770 issued to John Stevens, March 23, 1880

experiments to discover the difference in speed each should run in relation to the other. The rolls were rotated in opposite directions to carry the grain through between them, but one roll ran faster than its mate. The adjustment of the mechanism was simply a matter of experiment. The device having proved successful, he reduced the size of the rolls to nine inches diameter, and set up several of these new machines in his own mills. Their superiority over the stone mills was at once apparent, whereupon the latter were all discarded and replaced by roller mills.

By the buhr stone process, his mills, running at their highest capacity could produce 200 barrels of flour a day. By the new process with the same power he made 500 barrels a day. By the old buhr stone process he could only obtain twenty-five per cent good flour, other mills only twenty per cent; while by his new process he had ninety per cent good flour. The significance of this invention can be better understood when it is stated that the good or high grade flour brought $2.00 a barrel more than the lower grade, and thus Clement and Stevens were making a large profit each day over their competitors. They had more than doubled their output and quadrupled the quality without any additional mill power or expense of operation. No wonder these results created excitement. The mill was kept securely locked, but people broke in and took plans. A watchman was secured but they evaded him.

The experiments begun in 1870, continued until the roller mill was successfully operated in 1874. Then Stevens applied to the oldest patent law firm in the United States to draw his specifications and obtain his patents. They filed the claim for the rollers and were refused a patent, as the patent office would not grant a patent on rollers; they were very old, though never before applied in this way. Finally after two years' delay Stevens sought Parkinson and Parkinson, a patent law firm of Cincinnati, who seemed better to understand his invention, and filed his application December 28, 1877, for

a "grain crushing roll invented by John Stevens, Neenah, Wisconsin."

This application was witnessed by his partner J. L. Clement, and by A. W. Hart. The claim is: "In a grinding mill, the combination of rolls geered to revolve at different peripheral rates of speed, and having a dress composed of fine parallel grooves laid near together, with appreciable plane surfaces between and so as to cross each other on the contiguous surfaces of the rolls." For this a patent was granted, number 225,770, dated March 23, 1880. (See Figure 3.)

As stated in the specification, "the mill is employed for cracking wheat or other grain, and operating on the same, through the various stages of its reduction to flour and also for grinding and cleaning the bran," and the action of the spiral grooves operated as specified, was "admirably adapted to strip adhering starch and gluten from the bran." These grooves crossing each other in manner as stated, leave "the husk and germ in the flakey or discoidal condition, most conducive to its effectual separation from the flour and middlings." This patent Stevens named "the fine scratch roll," and was the "foundation patent," and absolutely a new discovery in milling practice, the most profound in its results of any other device ever invented in the mechanics of flour milling. February 13, 1878, he made application for a patent, issued May 25, 1880, No. 228,001, for "the roller grinding mill;" this was his roll dressed on its face with the round rib, or wash-board face. This application was witnessed by Solon C. Kemmon and Charles A. Pettit. As outlined in the specifications, the object aimed in milling is, "to increase the proportion of middlings and pure flour, leaving the bran and germ in a condition most favorable to their removal. Smooth surfaced rolls would flatten the germ, and allow the bran to pass unpulverized, "and to this extent accomplish the object, but they also cause the middlings to cake or form into flakes or thin disks, that will not pass the meshes of the bolt, and therefore in the end not satisfactory. On the other hand grooved rolls with sharp edges cut or tear the bran and germ

into fine particles," and it gets into the flour. The round rib was "designed to overcome these objections," and is the system of dressing roller mill in universal use today the world over.

It was in this patent, that the system of "gradual reduction" was outlined and described by Stevens, by which the grain was to pass in succession through one set of rolls after another, being bolted or cleaned between each set, and each set having a different degree of fineness to its corrugation. The usual number of sets in the system is six. The first or break rolls have ten ribs or corrugated lines to one inch; the second set or second break had twelve to fourteen ribs; the third set had sixteen to eighteen ribs; the fourth eighteen to twenty; the fifth twenty-two to twenty-four; and the sixth had as many as thirty-two ribs to the inch, being mere scratches and intended for middlings rolls. In applying for a patent on this system he made a claim which was allowed and reads as follows: "The process of reducing grain to flour, consisting in passing it through a series of sets of rolls, graded in respect to fineness of dress, and through bolts, intermediate between each set, and the succeeding set of rolls." This system is now the universal practice in milling throughout the civilized world.

To prevent a possible attempt to set aside his roller system operated in pairs, he devised and applied for a patent on December 16, 1879, for a "grinding mill" having a single roll and a concave stationary face between which the grain was to pass. Patent number 230,834 was issued to John Stevens for this on August 3, 1880. On November 4, 1880, he applied for a patent on a dial indicator, devised so that the operator could instantly adjust the rolls to each other. This patent issued the next month, December 28, 1880, numbered 236,104. The application for this was witnessed by the late Hon. Robert Shiells and Alexander McNaughton. In December 16, 1879, he made application for a "blunt non-cutting crest" dressing of the rolls to supplement his system; and for this a later patent was issued January 24, 1882, number

252,705. December 29, 1882, Stevens made application for a patent on his complete roller mill frame and housing with adjustments designed for single sets in one frame or double sets. This was witnessed by J. P. Shiells and the late Alexander McNaughton. Letters patent were issued September 2, 1884, number 304,468.

These are the six essential patents Stevens obtained for the invention of the roller mill. The first two are the basic devices which place his name high in the annals of invention. As soon as his mill was fitted, and operated at enormous profits, by the new system, it was next to impossible to keep it to himself. Very soon all the local machine shops were engaged nights and Sundays in secretly trying to form roller sets. Other machine shops did find out the system; and mill-furnishing concerns vied with each other in devising roller mills. The issue of his patent hung so long in the patent office, that by 1880, when it was finally issued, the system had been mentioned in the press and talked of for six years.[2]

In 1878 occurred the great flour-mill fire in Minneapolis that was attended by a disastrous explosion of flour mill dust, and considerable loss of life. Governor Washburn and others rebuilt at once, and introduced largely the new devices and gradual reduction rolls. Two years later, soon after obtaining his first two basic patents, Stevens visited the mills at Minneapolis where twenty-two mill-firms (in the city) settled with him, and took shop rights to run the patent rolls. Most other mills that had introduced his new system settled at once and took shop rights.

Stevens also took out patents in Canada, England, Germany, France, and Austria.

As soon as the basic patent for the roller mill was obtained by Stevens, he arranged with John T. Noye & Sons Co. of

[2] Harney, *Winnebago County*, states that "these mills at Neenah are chiefly large substantial structures with all modern improvements in flour mill machinery, to which within the last two years has been added the new patent machinery for the manufacture of patent flour. Patent flour now constitutes about eighty per cent of their product."

Buffalo, to manufacture on a royalty, which was paid to him for thirteen years, and this great mill-furnishing firm became very successful. In a contemporary letter from one of the well-known flour mill firms of Milwaukee to the John T. Noye & Sons Company, under date of November 22, 1880, it is stated:

> In reply to your inquiry as to how we like the Stevens Rollers are pleased to say they exceed our most sanguine expectations both in the quality of the work, and the percentage of good middlings. The corrugations being non-cutting, do not cut up the germ nor bran, like the sharp cutting roll, consequently the break flour is very white. The longer we use them the better the results. We only regret that we did not know of them before we commenced our improvements, that we might have had them on all our reductions.
>
> Yours very truly,
>
> S. H. Seamans & Co.

After thirteen years' operation under a license to make, the Buffalo firm in 1893 purchased, for the use of a syndicate of mill-furnishers, which would now be called a trust, the entire rights of Stevens in all his roller mill patents, including patents on his automatic dumping and self-registering scale for handling grain.

The useful results of this invention are numerous and we can only outline a few of the important ones. In milling it is desirable to have the granular grains or atoms of flour all the same size; as, if some are smaller, they take the yeast first, and turn it black. This makes heavy bread. The new-process milling produces the regular, granular grain. By use of the rolls, also, the beard of wheat is not broken and pulverized into the mass, as in the old buhr stone system. The germ is so handled in the new process as to be separated from the flour, and passed off into the bran, though in the practice of some mills it is utilized for a low grade flour and sold to a cheap trade.

In the new-process milling the husk or shell containing the black cells is crushed together and passed over the bolts with the bran, not pulverized into the mass as in the old-process milling. This makes it possible to utilize hard wheat. Wheat grows only in the temperate zone and north to an is-

othermal line where it will not ripen. It is richest in nutritious parts useful as a food, when grown nearest that northern cold line where it will not ripen. This wheat is characterized as hard or red spring wheat and grows best on the barren plains of the Dakotas, and throughout that then almost unknown, but vast region of western Canada, now fast filling with wheat-raising settlers. Under the buhr-stone milling process this wheat could not be used at the same price as softer grade, and sold for less than winter wheat, as explained above. The roller mill has made it the most valuable of the wheat grains and gives it the highest price as it has the highest food value. Some day this invention of John Stevens will make Canada a rival to the United States in flour production.

The introduction of the roller system in the Minneapolis mills in 1880, added one hundred thousand people to the citizenship of that place in five years, and made it almost at a single bound the flour milling emporium of America; by 1886, sweeping into its mills annually thirty-three million bushels of wheat, that ten years before was almost worthless; and settling the bleak northwestern prairies with several millions of hardy pioneers raising wheat. This invention drove wheat raising from Wisconsin and the Middle West, and closed the flour mills of Stevens's own city.[3]

[3] That this change is still continuing is shown by the following quotation from the last State census: "The acreage of wheat has decreased from 417,163 acres in 1895 to 210,010 in 1905, and the value from $4,225,728, to $2,267,701." The tobacco crop of Wisconsin is valued at three hundred thousand dollars more than the wheat crop. During the same census decade, the cheese and butter output in the State increased in value $20,401,000. The total increase in the value of all other farm products is $106,000,000, while wheat fell off one-half in product and value. In 1895, according to reports made to the Oshkosh *Northwestern*, 1,500,650 bushels of wheat were raised in Winnebago County. By the census of 1905, on an acreage of 2,984, there were but 35,216 bushels raised in the same county; and by this (1907) year's report made by the assessors to the county clerk, the acreage has been reduced to less than half, or 1272 in two years.

Invention of Roller Flour Mill

Not only did Stevens's invention affect the activities of vast acres of farm lands, but it also made it impossible and unprofitable to mill longer with the buhr stone. There was no market for the product. The invention of the roller mill made a scrap heap of half a billion dollars invested in mill-machinery around the civilized world. The writer was caught in the flood with two mills, and as no one would buy or sell the flour they made, though it was the good old flour of our childhood, his loss was thirty thousand dollars.

Dr. Graham, who advocated the use of Graham or whole wheat flour, was partly correct, as the best part of the flour was fed to cattle with the middlings; but to use Dr. Graham's flour now, would be a mistake. There is no nutriment in the bran. The middlings are reground on the finest or last set of rolls in the series, and the flour resultant brings the highest price and has the highest food value. The new system has made it possible to obtain this result. This flour is richer than the wheat. The term now so generally in use, "patent flour," is that applied to the roller-milling process.

The saving of power by the use of the roller mill was of great economic value in itself. The reason for this saving is, that a shorter lever is needed for the rolls, compared with that of the old stone. From the centre of the stone where the power of propulsion was applied, to the edge where the power was expended, was twenty-five inches. In the roll the distance from the centre to the edge is but four and a half inches. The relative value of energy saved was the difference between the shorter and longer lever. In reality it is much more, because of the saving in power necessary to actuate the new bolting system, made possible by the character of materials delivered from the rolls, thus making it possible and desirable to discard the old and cumbersome system of reel bolts.

Our inventor has travelled in every country on the globe, but his first return visit to Great Britain was not made until May, 1874, when he visited Scotland with the late Hon. Robert Shiells, two years after his invention of the roller mill.

He did not visit Hungary until 1884, four years after his basic patents had been issued, and three years after he had sold all interest in flour mills, and twelve years after his invention had been made. So there can be no truth in the current rumor that he found the roller mill in Hungary, and brought it home with him. By the time he reached Hungary, the only roller mill ever devised in that country was a curiosity or had been sold for old iron. The system invented by Stevens was patented to him by the Austrian government, and adopted everywhere in that country, where no one any longer cares for black bread. The old black bread mills of Budapest now vie with each other in a competition for the whitest bread. The wheat saw-mill once in use in Hungary is described on a former page, and had no resemblance to the Stevens non-cutting rolls. Governor Washburn's success in milling has been erroneously attributed to the introduction of the Hungarian system of gradual reduction milling. There was no such system in Hungary, only that described above, and this if it had been introduced in Minneapolis would never have made successful milling.

The annual wheat product of the United States is seven hundred million bushels, which will make one hundred and fifty million barrels of flour, worth nine hundred million dollars. The net cost of milling has been reduced one-half by the invention of Stevens; and supposing this saving in cost of production is partly if not entirely the gain of the consumer, then the people of the United States save each year forty million dollars because of this invention.